HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER MONITORING PROGRAM FOR TANK FARM #5
CONTRACT NUMBER N62472-82-2-1781

June 24, 1983

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HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER MONITORING PROGRAM FOR TANK FARM #5

CONTRACT NUMBER N62472-82-2-1781

Prepared for:

Naval Education and Training Center
Newport, Rhode Island
(Attn: Code 42)

Prepared by:

GHR Engineering Corporation
75 Tarkiln Hill Road
New Bedford, Massachusetts 02745

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HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER MONITORING PROGRAM FOR TANK FARM #5

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PRELIMINARY HYDROGEOLOGIC INVESTIGATION AND GROUNDWATER MONITORING PROGRAM FOR TANK FARM #5

1.00 INTRODUCTION AND BACKGROUND

The Naval Education and Training Center (NETC) in Newport, Rhode Island is currently storing waste fuel oil, motor oil and hydraulic oil in two subsurface prestressed concrete tanks (#53 an 56) in an area known as Tank Farm #5. This waste is considered hazardous by the State of Rhode Island, in accordance with its Hazardous Waste Management Regulations. Federal and State regulations require that a groundwater monitoring program be developed and instituted.

The Rhode Island Department of Environmental Management (RIDEM) has requested the NETC to obtain the services of a registered professional engineer to develop a groundwater monitoring program for Tanks #53 and 56. GHR Engineering has been retained by the NETC to accomplish this task.

As mutually agreed upon by NETC and GHR, a subsurface investigation of the area encompassing Tanks #53 and 56 was conducted on May 31, 1983 to characterize the site's geology and hydrology. The information generated during this investigation aided in the development of the groundwater monitoring program.

This report discusses the results of the subsurface investigation and presents comprehensive groundwater monitoring program that is in compliance with the Rhode Island Hazardous Waste Treatment and Storage Facilities Rules and Regulations, as amended.

1.10 Study Area Description

Tank Farm #5 is located on 7.34 acres of land bounded on the south by St. Columbus Cemetery, on the west by Defense Highway, on the north by Greene Lane and on the east by a private parcel of land (Figure 1-1). Oil storage Tanks #53 and 56 upon which the subsurface investigation and monitoring plan focus, are located near the south edge of the Tank Farm property.

Tanks #53 and 56 are situated on the northwest flank of a hill that is aligned northwest to southeast. Ground surface in the study area slopes to the west from an elevation of approximately 95 feet (above mean sea level datum) near Tank #59, to an elevation of approximately 45 feet along Defense Highway (Figure 1-2).

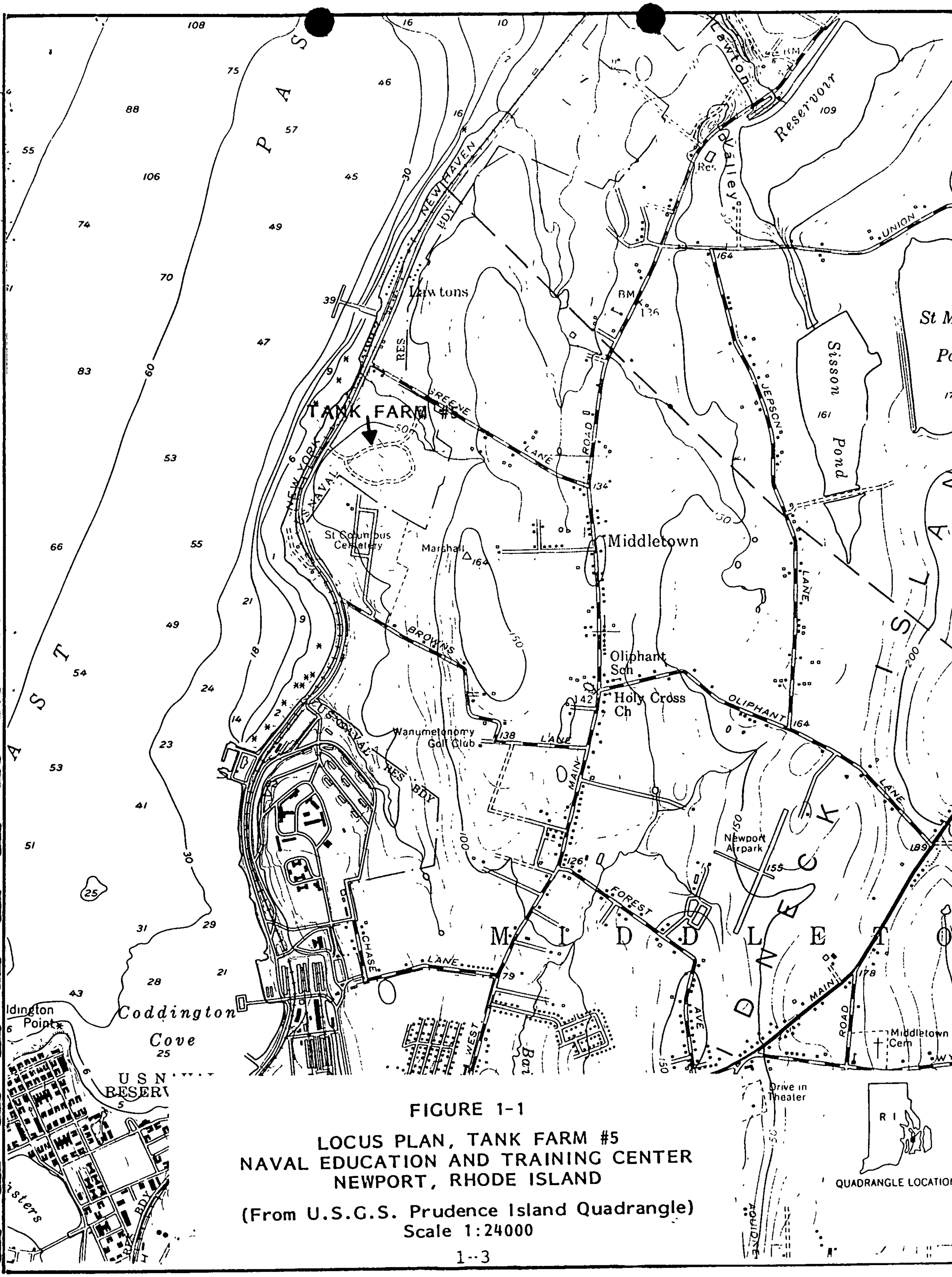


FIGURE 1-1

LOCUS PLAN, TANK FARM #5
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

(From U.S.G.S. Prudence Island Quadrangle)
Scale 1:24000

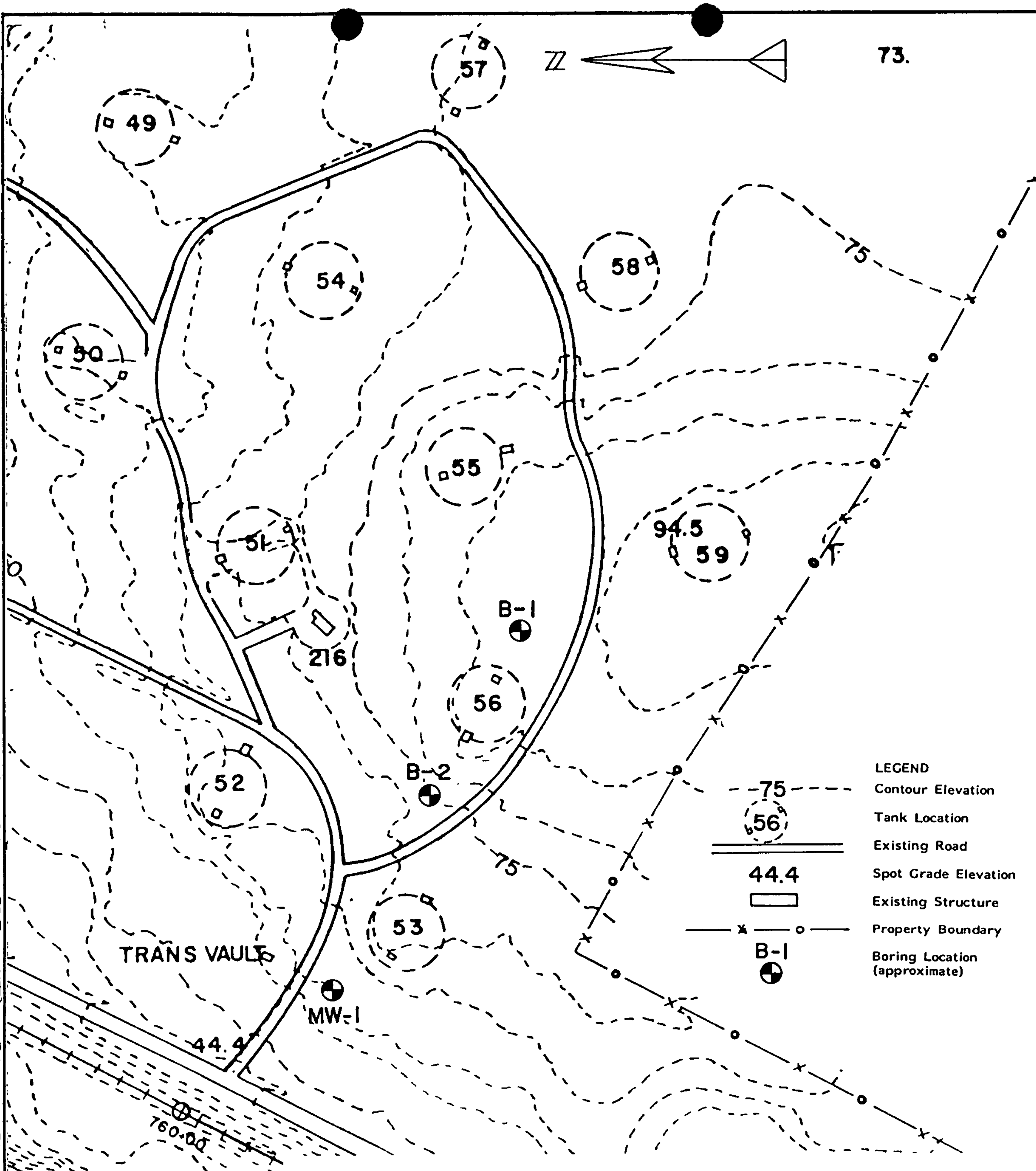


FIGURE 1-2

SITE PLAN, TANK FARM #5
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND
(From Naval Facilities Engineering Command,
Existing Conditions Map, 1969)

Scale 1" = 200'

2.00 DESCRIPTION OF THE SUBSURFACE INVESTIGATION

The purpose of the subsurface investigation was to generate sufficient information concerning the surficial geology, bedrock geology and groundwater hydrology around Tanks #53 and 56 to allow the development of a groundwater monitoring program for this area. This investigation included the following:

1. Execution of three test borings to characterize the soils, determine depth to bedrock and the water table and assess the general competency of the bedrock; and,

2. Installation of a temporary monitoring well down-gradient of Tank #53 to allow determination of water table elevation and to serve as a possible future groundwater sampling point.

2.10 Test Borings

Three test borings were executed at the site on May 31, 1983. The borings were supervised and logged by a GHR geologist and drilling performed by D.L. Maher, Inc. of North Reading, Massachusetts. The borings were executed using a truck-mounted, hydraulic rotary auger rig. The locations of the borings, labelled B-1, B-2 and MW-1 (Boring #3 in which a monitoring well was installed), are shown on Figure 1-2. Standard penetration tests yielding split-spoon samples were conducted at 5-foot intervals or at strata changes. Boring logs were prepared for each hole and are included in Appendix "A". Borings B-1 and B-2 penetrated all soil strate and terminated on top of bedrock. Boring MW-1 was advanced through the soil and cored 20 feet into bedrock. The interpretation made from the test borings are discussed in detail in Section 3.00.

2.20 Monitoring Well Installation

A temporary groundwater monitoring well, MW-1, was installed downgradient of Tank #53 (Figure 1-2). The well consists of Schedule 80 PVC, 2-inch I.D. slotted screen (.010 inch), attached with PVC couplings to a riser pipe. The well was screened in both bedrock and overburden to allow measurements of possible water table movement into and out of the bedrock. Details of the monitoring well construction are presented in Appendix "A".

The temporary monitoring well was installed to determine the elevation of the water table so that the depths to which permanent monitoring wells would have to be installed could be estimated. This temporary well will be made part of the permanent monitoring system and used as a future groundwater sampling point. However, if it is to serve this purpose, it is suggested that a security pipe with locking cap be placed over the well to prevent tampering or vandalism to the well.

3.00 SITE HYDROGEOLOGY

Regional geologic and hydrogeologic information for the study area has been prepared and mapped by Davis[1], Gauthier and Schiner[2] and C.A. Maguire and Associates[3]. Findings made during the current subsurface investigation generally agree with the data provided in these publications.

3.10 Regional Geologic Setting

The study area is located in the Atlantic Coastal Plain physiographic province of the New England Upland Region. This area of Southeastern Rhode Island is characterized by a sedimentary basement complex of Pennsylvania age rock, known as the Rhode Island Formation. These rocks, comprising the Narragansett Basin in Southeastern Massachusetts and Rhode Island, are predominately nonmarine clastics, ranging in composition from conglomerate to shale.

The bedrock surface through most of the region has been contoured by glaciation into a series of sub-parallel valleys and ridges. The bedrock in the Newport area is almost everywhere mantled by unconsolidated dense glacial till generally 20 feet thick.

3.20 Geologic Materials

For the purpose of this study, the geologic units of prime interest consist of glacial till and sedimentary bedrock. Artificial fill used during tank construction is also found on the site. The major emphasis of this report focuses on bedrock, since it is in the rock that groundwater is found and potential contaminants from Tanks #53 and 56 may be migrating. The geologic units are described below from the top of the stratigraphic column (ground surface) to bedrock.

3.21 Artificial Fill

Borings B-1 and B-2 encountered artificial fill consisting of grey crushed shale and silt with a trace of clay. The depth of this material ranged from 2 to 4 feet. The fill is likely the remains of the material removed by excavation and blasting for construction of the Tank Farm.

3.22 Glacial Till

All three borings encountered glacial till consisting of a very dense mixture varying in composition with depth. Generally, the top 5 feet of till consists of grey weathered shale, sand and silt with minor amounts of clay, sometimes alternating with bands of oxidized medium to fine sand, silt and clay. The bottom 10 feet of till down to bedrock consists of highly weathered grey shale ("rottenstone"), sometimes rust-stained due to oxidation. This material was extremely friable, easily splitting along bedding planes.

The glacial till originated as rock and soil fragments of all sizes were eroded by the moving glacial ice, carried a few miles, and deposited as the ice dragged along the bedrock or when it melted.

3.23 Bedrock

Borings B-1 and B-2 were advanced to the top of bedrock, and Boring MW-1 cored 20 feet into bedrock. Bedrock was encountered at an average depth of 21 feet. This indicates that the bedrock surface topography generally reflects the ground surface topography.

The bedrock belongs to the Rhode Island Formation, a Pennsylvania-age sedimentary rock, and consists of a grey-to dark grey-to black, shale and meta-anthracite. The rock is carbonaceous, as evidenced by the graphite sheen given off when a crushed sample is immersed in water and is pyritic (contains pyrite, an iron sulphide mineral) which accounts for the rocks' rusty color when it is oxidized.

The bedrock is highly weathered along its surface, but becomes more competent with depth as indicated by increased drilling difficulty with depth. Outcrops of this bedrock in the vicinity of the shady area indicate that the rock is laminated and is fissile (splits) along bedding planes. A limited number of fractures and faults cut across the bedding planes.

3.30 Hydrology

3.31 Surface Water

The area surrounding Tanks #53 and 56 drains by surface water runoff in a northwesterly direction toward Defense Highway. There are no surface water bodies in this area of the site. According to U.S. Geologic Survey water resources data, the average annual precipitation for this area is 44 inches. Of this annual amount, approximately 24 inches per year drain by surface runoff. The remaining precipitation either returns to the atmosphere via evapotranspiration or infiltrates into the ground to recharge the groundwater system.

3.32 Groundwater

As a result of the current subsurface investigation, it was found that groundwater is stored in and may be transmitted by the joints, fractures and bedding planes in the bedrock. Groundwater was not encountered in the glacial till. The exact depth of the water table was not measured during the investigation, since water was pumped into the borehole for MW-1 during rock coring. However, based on previous investigations performed on the site[3], the water table was found to be located approximately 30 feet below ground level. The exact water table elevation in MW-1 will be determined after the well is surveyed and allowed to stabilize. The water table elevation can be tied into the elevations determined in the proposed monitoring wells to allow generation of a water table profile map as part of the groundwater monitoring program.

Of primary interest in the evaluation of groundwater in the bedrock is the permeability of the rock, the direction of groundwater flow, and the flow velocity. Permeability values should be determined during installation of the proposed permanent monitoring wells. However, based on existing information[2], the bedrock appears to have a relatively low permeability value. Yields of bedrock wells in the area range from less than 1 to 55 gallons per minute (GPM)[2]. About 7 out of every 10 wells yield less than 10 GPM[2]. Therefore, the bedrock appears to be relatively "tight" with respect to groundwater flow.

Based on preliminary information, the groundwater flow direction in respect to Tanks #53 and 56 is toward the northwest. Accurate flow directions should be assessed after installation of the proposed monitoring wells.

The flow velocity through bedrock is expected to be relatively low due to the low permeability of the rock. Falling head and/or rising head permeability tests should be performed during installation of the proposed wells. The permeability values derived from these tests can be used to determine flow velocities.

It is expected that the hydraulic parameters for the bedrock have been altered in the areas immediately surrounding Tanks #53 and 56, since disturbance of the rock took place during installation of the tanks. Blasting and excavating the bedrock would likely create fractures which would increase permeability and flow velocities in the immediate vicinity of the tanks. Additionally, the backfill material used around the tanks would likely have higher permeability and flow velocity values than the surrounding glacial till, since the crushed shale used for backfill would have a higher void ratio than the till. For these reasons, if waste oil is seeping from the tank(s), the insoluble portions may concentrate around the tank(s) and not move into the native bedrock. This possibility should be explored during the institution of the groundwater monitoring program.

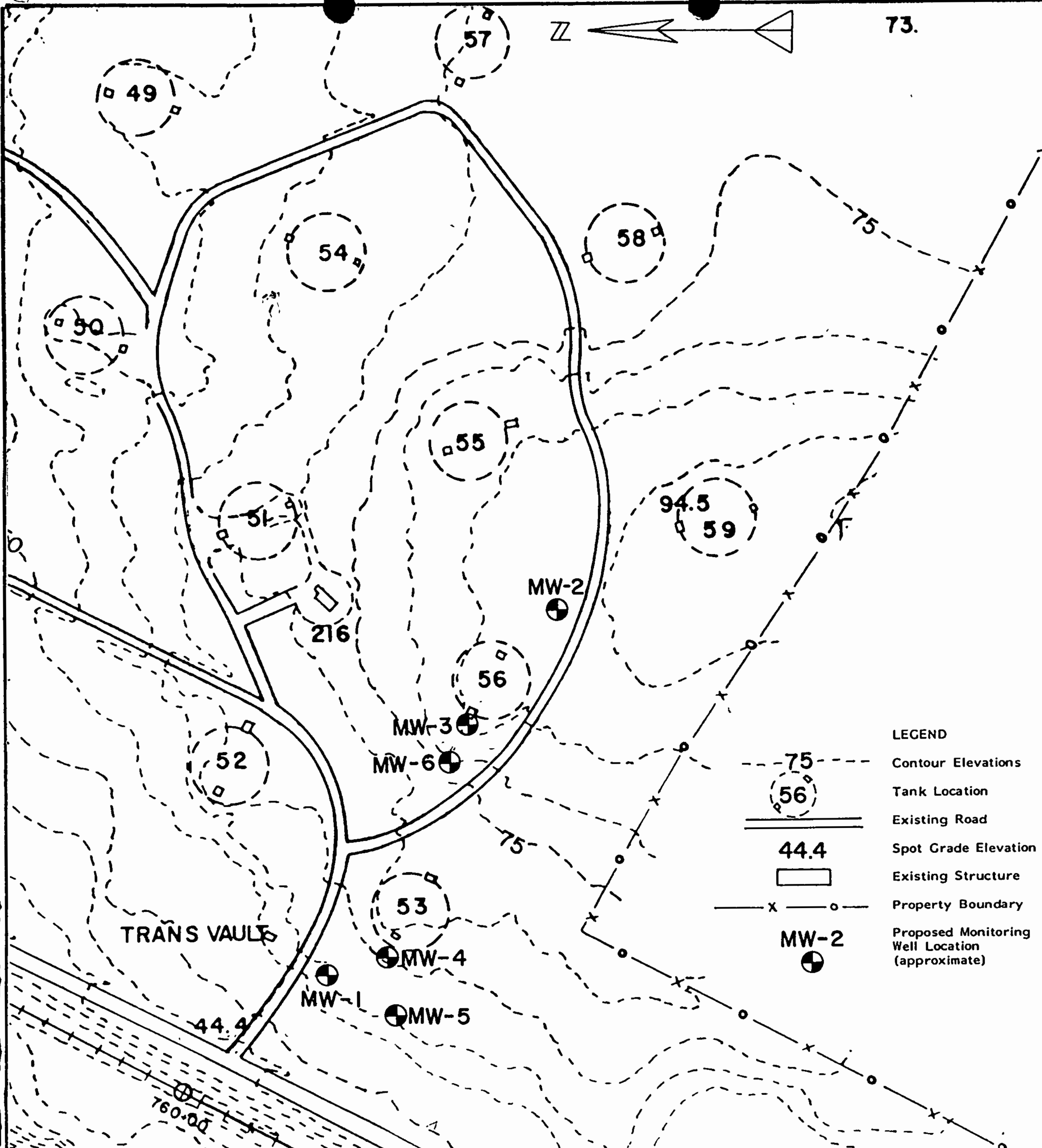


FIGURE 4-1

PROPOSED MONITORING WELL LOCATIONS
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND
(From Naval Facilities Engineering Command, Existing Conditions Map, 1969)

Scale 1" = 200'

4.00 PROPOSED GROUNDWATER MONITORING PROGRAM

The proposed groundwater monitoring program is based on a review of existing regional information and site-specific data generated during the current subsurface investigation on the geology and hydrology of the study area and the site's history. The program has been prepared in compliance with Federal Regulation 40 CFR 264.90-264.99. The following characteristics unique to this site, have been addressed in the monitoring plan:

1. Groundwater is supported in a bedrock aquifer and therefore its movement is controlled by the frequency and orientation of fractures, joints, faults and bedding planes and by regional hydraulic gradient.

2. The hydraulic characteristics of the bedrock and fill materials surrounding the tanks may differ from the native bedrock and till. Therefore, insoluble waste oil that may be leaching from the tanks would likely concentrate around the tanks and not move into the surrounding rock.

3. The waste products stored in the tanks have specific gravities less than water and therefore, would migrate along the top of the water table. The wastes that are soluble in water and are typically present in petroleum products such as benzene, toluene, ethylbenzene and xylenes would disperse in groundwater and move in the direction of regional groundwater flow.

4.10 Proposed Plan of Study

The objectives of the proposed groundwater monitoring program are as follows:

1. Assess the hydrologic parameters controlling groundwater movement in the study area;

2. Evaluate the potential for contaminants to migrate through the groundwater system from Tanks #53 and 56;

3. Establish the extent, if any, of groundwater contamination; and,

4. Determine the potential impact to environmentally sensitive areas in the vicinity of Tank Farm #5 if contamination is found to be migrating from Tanks #53 and 56.

To accomplish these objectives, it will be necessary to initiate a groundwater monitoring program. The various components of this program are described below.

4.11 Boring Program and Monitoring Well Installation

The boring program and monitoring well installation will provide the needed data on soil properties, aquifer parameters and groundwater quality. The installation of a groundwater monitoring network around Tanks #53 and 56 will include the proposed boring and well locations shown on Figure 4-1. The rationales behind the selected well locations are outlined below:

MW-1

Installed downgradient of Tanks #53 and 56 during the preliminary investigation. Will be upgraded and made part of the permanent monitoring network by installing a security pipe with locking cap over the well.

MW-2

Located upgradient of groundwater flow, will be used as a control well to establish background groundwater quality upgradient of Tanks #53 and 56. Analytical results from downgradient wells (Nos. 1, 3-6) will be compared with results from MW-2 to determine if groundwater quality has been adversely affected by the subject tanks.

MW-3

Located immediately downgradient of Tank #56. Will be installed in the fill material surrounding the tank, since this material may be acting as a reservoir for insoluable hydrocarbon products that could potentially leach from the tank.

MW-4

Located immediately downgradient of Tank #53. Will be installed in the fill material surrounding the tank to detect potential leaks.

MW-5

Located downgradient of Tanks #53 and 56. Along with MW-1, this well will be capable of detecting the soluble components of waste oil that would migrate radially outward from the tanks in the event of a leak(s).

MW-6 (Optional Well)

In the event that evidence of an obvious leak in Tank #56 is noted during the installation of MW-3 (hydrocarbon product staining in split-spoon samples or an oily sheen in the wash water) MW-6 will be installed downgradient of Tank #56 to ascertain if the soluble components of the waste oil are migrating through the native bedrock.

Each boring will be executed into bedrock to a depth of at least 10 feet below the water table. Borings will be executed with a 6-inch O.D. hollow-stem auger. Bedrock will be rotary cored with a 4.25-inch roller bit. In the overburden, split-spoon samples will be collected at 5-foot intervals in advance of the auger for physical identification and possible future chemical testing. Boring and monitoring well installation logs such as those shown in Appendix "A" will be recorded for each boring.

During the boring and split-spoon operation, the equipment used will be thoroughly cleaned and rinsed to prevent cross-contamination of samples within each boring and from one boring to another. A portable steam generator and rinse tank will be used to decontaminate equipment coming in contact with contaminated soils and/or water.

Monitoring wells will be constructed of Schedule 80 PVC, 2-inch I.D. slotted screen (.010 inch), attached with PVC couplings to a solid riser pipe. The bottom of the slotted screen will be capped. Suitable porous materials (Ottawa sand or #2 Morie sand) will be placed around the well screens and bentonite installed near the ground surface to prevent infiltration of potentially contaminated surface water. Well screens will be set 10 feet below and 5 feet above the water table to allow measurements of water table fluctuation. Security pipes with locking caps will be placed over the PVC riser to prevent tampering or vandalism to the well. Figure 4-2 shows the design of the typical well that will be installed for this monitoring program.

4.12 Site Survey

The locations and elevations of monitoring Wells 1 thru 5 (possibly 6) will be surveyed to allow depths to bedrock and the water table to be adjusted to elevations above sea level. These elevations will be added to the existing site plan. The site plan, which will appear in the groundwater monitoring report, will show ground elevation contours, buildings, boundaries, roadways, locations of tanks and monitoring wells and groundwater elevations, contours and flow directions.

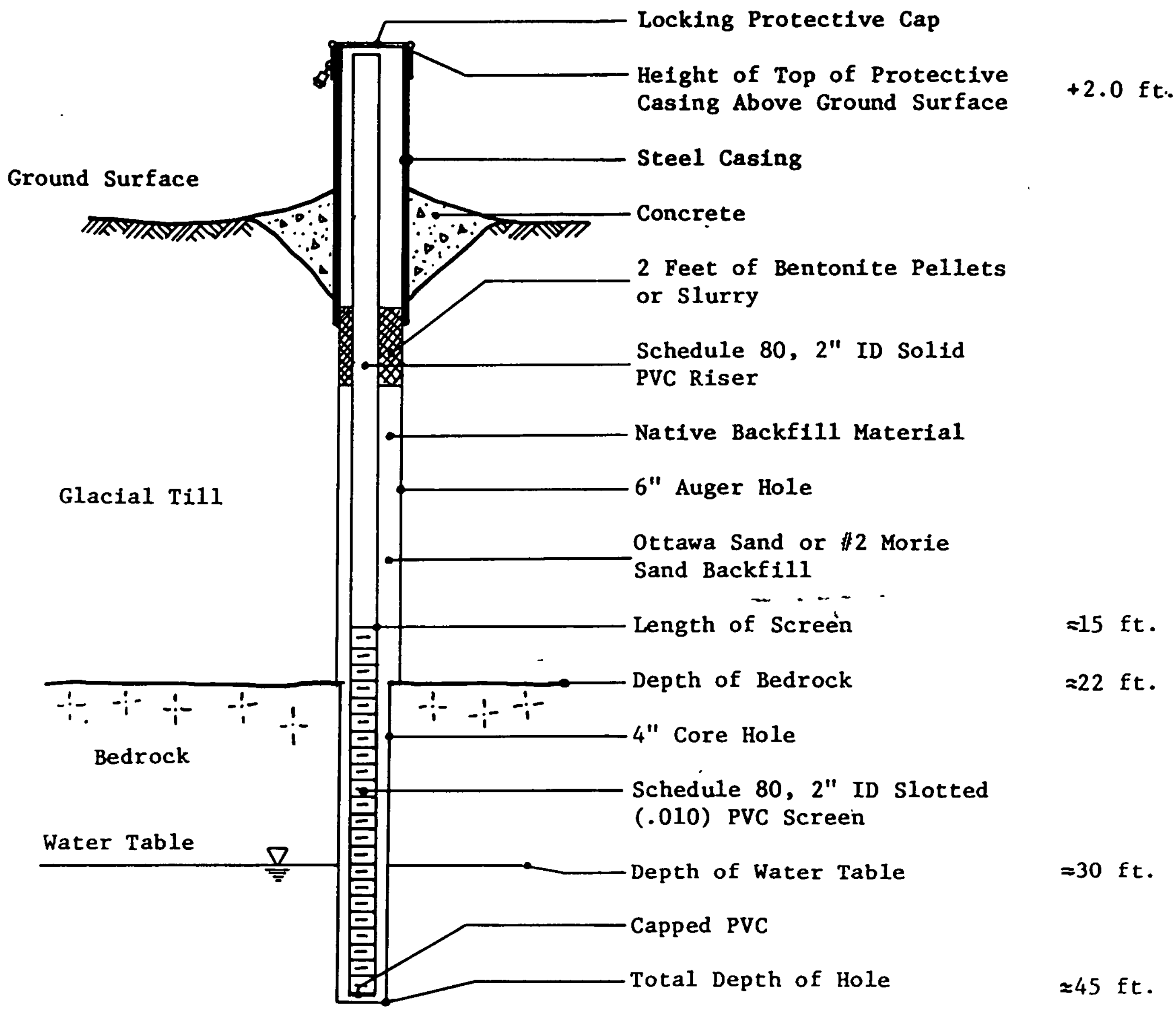


FIGURE 4-2

MONITORING WELL CONSTRUCTION SPECIFICS

4.13 Groundwater Sampling

After development and stabilization of the monitoring wells, water table elevations will be measured for use in the generation of the groundwater contour and flow direction map. Prior to withdrawing groundwater samples using a PVC bailer, at least 3 static volumes of water will be withdrawn from each well. All sampling equipment will be thoroughly decontaminated by rinsing in methanol then distilled water between wells to prevent cross-contamination of samples.

Groundwater samples will be taken and handled in accordance with EPA protocol and transferred to an approved contract laboratory following strict chain-of-custody procedures.

4.14 Groundwater Analysis

Groundwater samples will initially be analyzed for the parameters required under 40 CFR 264.90-264.99 and for the constituents most likely to be found leaching from Tank #53 and 56 based upon a review of the products historically stored in the tanks. The initial analytical program will focus on the following: groups.

Group 1

EPA Priority Pollutants

- Purgeable Volatile Organics (EPA Method 624)
- Extractable Volatile Organics (EPA Method 625)
- PCB's and Pesticides (EPA Method 625)
- Herbicides (EPA Method 625)

Group 2

Metals (EPA Publication No. 600/4-79-020 Methods for the Chemical Analysis of Water and Wastes)

- Arsenic
- Barium
- Cadmium
- Chromium

Group 2 - Metals Continued

- Lead
- Mercury
- Selenium
- Silver

Group 3

Indicator Parameters

- Total Organic Carbon (TOC)
- Total Organic Halogens (TOX)
- pH
- Specific Conductance

Analytical values obtained from the initial round of sampling will be used to establish baseline groundwater quality and establish analytical protocol for subsequent sampling. Water from wells which show detectable levels of the constituents indicated in Group 1 from the initial sampling effort will continue to be analyzed for these constituents, plus those from Groups 2 and 3. Wells which do not show detectable levels of constituents from Group 1 will be analyzed for Group 2 and the indicator parameters in Group 3 during subsequent sampling. If future sampling reveals an increase in Group 3 indicators, then those wells showing the increase will be analyzed for Group 1 parameters also. Figure 4-3 outlines the analytical program.

FIGURE 4-3

GROUNDWATER ANALYTICAL PROGRAM

Round 1 Sampling

Analyze For:
Group 1 - Priority Pollutants
Group 2 - Metals
Group 3 - Indicator Parameters

Wells Show Constituents from Groups 1,2,3	Wells Show Constituents from Groups 2 and 3
Subsequent Sampling	
Analyze for Groups 1,2,3	Analyze for Groups 2 and 3 If Wells Show Constituents from Group 1

4.15 Groundwater Sampling Schedule

Sampling will take place on a quarterly basis (every 3 months) for the first year and semi-annually thereafter during the active life of the tanks and during the post-closure period.

4.16 Data Evaluation and Report of Results

Upon completion of Round 1 laboratory analyses, a report on the work performed and the results obtained will be prepared and submitted to the RI DEM. The report will include:

- description of field procedures, including sampling methods;
- description of laboratory procedures and equipment used in analyzing the various samples;
- site plan showing boring and well locations, sampling locations and major site features (buildings, boundaries, surface contours, etc.);
- subsurface profiles, based on boring logs, showing soil types encountered, water table, and any other relevant features;
- graphical and tabular summaries of chemical testing data for surface and groundwater;
- boring and well logs;
- groundwater monitoring data (water level elevations and gradients) and a groundwater contour map showing gradients and flow direction;
- an assessment of the extent of groundwater contamination (if any) that may be attributable to Tanks #53 and 56;

- an assessment of the potential impact to water resources in the area if contaminants are found to be migrating from the tanks;
- recommendations for further monitoring, and;
- recommendations for corrective measures, if needed.

Additionally, the following reports will be submitted to RI DEM:

1. Analytical results will be reported 15 days after completing each quarterly sampling during the first year of sampling.

2. Analytical results will be reported 15 days after completing each semi-annual sampling during the active and post-closure period.

3. Concentrations or values of sampling parameters that differ significantly from initial background levels found in the upgradient well will be reported no later than March 1, following each calendar year during the active life of the tanks.

4. Results of the evaluations of groundwater elevations will be reported no later than March 1 following each calendar year.

5. Results of the groundwater quality assessment program which includes but is not limited to, the calculated (or measured) rate of migration of contaminants in the groundwater will be reported no later than March 1 following each calendar year during the active life of the tanks.

Records of the analyses and associated groundwater elevations required under CFR 264.90-264.99 will be maintained by the NETC throughout the active life of the tanks and throughout the post-closure care period as well.

REFERENCES

1. Quinn, A.W., 1971, Bedrock Geology of Rhode Island, U.S. Geologic Survey Bulletin No. 1295.

2. Gonthier, J.B. and Schiner G.R., 1964, Groundwater Map No. 20 of Prudence Island and Newport Quadrangle, Rhode Island.

3. Charles A. Maguire and Associates, 1945, Report of Drilling, Test Pumping and Appurtenant Work at Area 5, U.S. Naval Net and Fuel Depot, Melville, Rhode Island.

APPENDIX A

BORING/SOIL SAMPLING REPORTS
OBSERVATION WELL SUMMARY LOG

BORING / SOIL SAMPLING REPORT

GHR

PROJECT Navy Oil Storage Tanks, Newport, RI

LOCATION Tank Farm #5 Upgradient of Tank 56

CLIENT Naval Education & Training Center

GHR FIELD ENGR. W. Norman

CONTRACTOR D.L. Maher, Bill Canty - Foreman

GROUND EL.

TOP CAS. EL.

WATER LEVEL READINGS

DATE | DEPTH Dry Hole

BORING No. B-1

SHEET 1 OF 1

ACCT. No.

DATE (S) 5/31/83

DEPTH	CAS. BL. /FT.	SAMPLE No.	PEN./REC.	DEPTH	BLOWS / 6"	GEN. STRATA DESC.	SAMPLE DESCRIPTION	NOTES
		S-1	12/12	0-1'	2/14	Topsoil 2.0	Brown silt, trace clay, organic mat (moist)	
						Artificial Fill 5.0	Grey silt, trace clay, crushed shale (moist)	1
5		S-2	18/12	5-6.5'	8/24/24/R		Fine brown sand, trace silt (5-5.5') Grading to Wx. shale-angular (dry)	
							Grey fine sand, silt, gravel (rounded sub-angular) (dry)	1
10		S-3	12/8	10-11'	29/38	Till	Wx. shale, Fe stained (dry)	
							Angular shale, quartz. Rock reveals an oily sheen when submersed in H2O	1
15		S-4	12/8	14-15'	24/39		Wx. shale, Fe stained (dry) some quartz. Same as S-3	
			Sample not kept - Same as #3					
							"	1
20		S-5	12/8	19-20'	24/34 for4"		"	
			Sample not kept - Same as #3,4			22.0	"	1
						Bedrock	Auger hit refusal @ 22'. Drove spoon no recovery. No G H2O. Encountered bedrock - grey carbonaceous shale	
25								

NOTES:

1. Soil description from auger cuttings.
   Wx. = weathered.

BORING / SOIL SAMPLING REPORT

GHR

PROJECT: Navy Oil Storage Tank, Newport, RI
LOCATION: Tank Farm #5 Downgradient of Tank 56
CLIENT: Naval Education & Training Center
GHR FIELD ENGR.: W. Norman
CONTRACTOR: D.L. Maher, Bill Canty - Foreman

GROUND EL.:
TOP CAS. EL.:

WATER LEVEL READINGS
DATE: | DEPTH: Dry Hole

BORING No.: B-2
SHEET: 1 OF 1
ACCT. No.:
DATE (S): 5/31/83

DEPTH	CAS. BL. /FT.	SAMPLE No.	PEN./REC.	DEPTH	BLOWS/6"	GEN. STRATA DESC.	SAMPLE DESCRIPTION	NOTES
			No sample taken. Same as B-1			Topsoil 1.5		
						Artific. Fill 5.0	Grey silt, trace clay, crushed shale	1
5		S-1	18/12	5-6.5'	5/6/10		Brown fine sand, trace silt. Grading to Wx. shale, Fe stained (dry)	
							Grey fine sand, silt, trace clay. Angular pieces of shale (dry)	1
10		S-2	10/8	10-11'	10/26	Till	Wx. shale (dry)	
							Drilled difficult. Wx. shale, silt, trace clay	1
15		S-3	12/11	14-15'	15/30		Wx. shale, grey silt, clay	
							"	1
		S-4	12/10	18-19'	19/37	19.0	"	
20		S-5		20.5'		Bedrock	Drilling hard @ 19'. Drove spoon. No recovery. No G H_2O Encountered. Bedrock, grey carbonaceous shale	

NOTES:
1. Soil description from auger cuttings.
   Wx. = weathered.

BORING / SOIL SAMPLING REPORT

GHR

PROJECT: Navy Oil Storage Tanks, Newport, RI

LOCATION: Tank Farm #5 Downgradient of Tank 53

CLIENT: Naval Education & Training Center

GHR FIELD ENGR.: W. Norman

CONTRACTOR: D.L. Maher, Bill Canty - Foreman

GROUND EL.:

TOP CAS. EL.:

WATER LEVEL READINGS

DATE: DEPTH:

BORING No.: MW-1

SHEET 1 OF 1

ACCT. No.:

DATE (S): 5/31/83

DEPTH	CAS. BL. /FT.	SAMPLE No.	PEN./REC.	SAMPLE DEPTH	BLOWS/6"	GEN. STRATA DESC.	SAMPLE DESCRIPTION	NOTES
			No sample	taken.	Same as B-1, 2	Topsoil		
							Brown fine sand & silt alternating with grey sand & silt with Wx. shale	1
5		S-1	18/11	5-6.5'	6/10/23		Brown fine sand, silt, grading into grey silt, trace clay, Wx. shale (alternating layers)	
							Alternating bands of brown m-f sand silt & grey f sand, silt, trace clay	1
10		S-2	18/10	10-11.5'	9/13/21	Till	Brown fine-med. sand, grading into grey silt, gravel Wx. shale (alternating bands)	
15		S-3		13.5-15'	10/21/37		Grey med-fine sand, silt, trace clay	1
							Wx. shale, silt, sample moist	
		S-4	12/8	18-19'	24/37		Grey-brown fine sand, silt, trace clay, Wx. shale	1
20							Lt. brown-tan Wx. shale (quartz intrusion)	
		S-5	6/6	23-23.5'	18 for 6"		"	1
						23.5	Lt. brown-tan Wx. shale	
25						Bedrock	Rotary drilled 23.5'-42' with 4¼" rotary bit Bedrock - grey-rust colored carbonaceous shale	

NOTES:

1. Soil description from auger cuttings.
   Wx. = weathered.

BORING / OBSERVATION WELL SUMMARY LOG

BORING No. MW-1

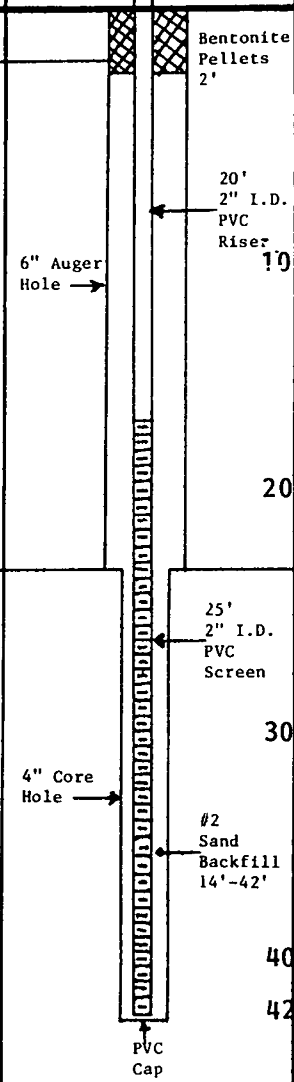
PROJECT Navy Oil Storage Tanks, Newport, RI SHEET 1 OF 1

LOCATION Tank Farm #5 Downgradient of Tank #53 CONTRACTOR D.L. Maher

CLIENT Naval Education & Training Center DATE INSTALLED 5/31/83

GHR FIELD ENGR. W. Norman

DEPTH	STRATA DESCRIPTIONS	INSTALLATION LOG	FIELD SAMPLING I.D. No.	FIELD SAMPLING DEPTH	FIELD SAMPLING SAMPLE DESCRIPTIONS	NOTES
1.5	Topsoil				See Boring/Soil Sampling Report for Sample Descriptions	
	Till					
23.5	Bedrock					



NOTES:

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ACCT. No.